

PACIFIC ISLANDS FISHERIES SCIENCE CENTER



Hawaii Marine Recreational Fisheries Survey

How Analysis of Raw Data Can Benefit Regional Fisheries Management and How Catch Estimates are Developed

An Example Using 2003 Data

Stewart D. Allen
Nicole Bartlett

May 2008



Administrative Report H-08-04

About this report

Pacific Islands Fisheries Science Center Administrative Reports are issued to promptly disseminate scientific and technical information to marine resource managers, scientists, and the general public. Their contents cover a range of topics, including biological and economic research, stock assessment, trends in fisheries, and other subjects. Administrative Reports typically have not been reviewed outside the Center. As such, they are considered informal publications. The material presented in Administrative Reports may later be published in the formal scientific literature after more rigorous verification, editing, and peer review.

Other publications are free to cite Administrative Reports as they wish provided the informal nature of the contents is clearly indicated and proper credit is given to the author(s).

Administrative Reports may be cited as follows:

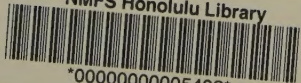
Author. Date. Title. Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Serv.,
NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent.
Admin. Rep. H-XX-YY, xx p.

For further information direct inquiries to

Chief, Scientific Information Services
Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce
2570 Dole Street
Honolulu, Hawaii 96822-2396

Phone: 808-983-5386
Fax: 808-983-2902

NMFS Honolulu Library



0000000005403

Pacific Islands Fisheries Science Center
Administrative Report H-08-04

Hawaii Marine Recreational Fisheries Survey

How Analysis of Raw Data Can Benefit
Regional Fisheries Management and
How Catch Estimates are Developed

An Example Using 2003 Data

Stewart D. Allen

Pacific Islands Fisheries Science Center
National Marine Fisheries Service
2570 Dole Street, Honolulu, Hawaii 96822-2396

Nicole Bartlett

Pacific Islands Regional Office
National Marine Fisheries Service
1601 Kapiolani Boulevard, Suite 1110, Honolulu, Hawaii 96817-4700

May 2008

CONTENTS

Introduction	1
Program Overview.....	2
Coastal Household Telephone Survey (CHTS).....	3
Methods and Procedures.....	4
Household Characteristics	5
Angler Characteristics	5
Trip Characteristics	6
Big Island Residents	6
Maui County Residents	6
Honolulu County (Oahu) Residents	7
Kauai County Residents	7
Target Species	7
Field Survey.....	9
Methods and Procedures.....	9
2003 Sample	11
Description of the Fisherman	12
Description of the Current Trip	14
Description of Catch.....	15
Development of Recreational Catch Estimates	17
Effort Estimates	17
Catch Estimates	19
Precision of Estimates	21
Accessing Survey Results.....	22
Ahi Catch and Related Information, 2003	22
Catch-per-unit-of-effort, Total Yellowfin Harvest.....	26
Conclusions and Technical Recommendations	27
Suggestions from Workshop	28
Telephone Survey Technical Recommendations	29
Fisherman Categorization.....	29
Island of Return	30
Hawaii Target Species	30
Field Survey Technical Recommendations	30
Monitoring Interviews	30
Survey Content	30
Data Entry.....	31
A Work in Progress	31
References	33
Appendices	
Appendix A: Phone Survey Questionnaire.....	A-1
Appendix B: Field Survey Questionnaire.....	B-1

INTRODUCTION

This report describes the results of a collaborative effort from 2004 to 2005 between Nicole Bartlett, then a statistician for the Marine Recreational Fisheries Statistics Survey (MRFSS) program staff at the National Oceanic and Atmospheric Administration (NOAA) Fisheries headquarters in Silver Spring, Maryland, and Stewart Allen, social scientist at Pacific Islands Fisheries Science Center (PIFSC) in Honolulu. The bulk of the project took place while Bartlett was at PIFSC on a rotational assignment from October 2004 to March 2005. The purpose of this project was to review, evaluate, and communicate the results from an initial year of conducting the MRFSS in Hawaii. The experiences of other states, as well as discussions among Hawaii policy makers and stakeholders, made it clear that accurate, timely data on recreational fishing in Hawaii will be critical.

One of the main products of the rotational assignment (in addition to this report) was a workshop held February 9, 2005, at the Western Pacific Regional Fishery Management Council office. The need for the workshop originated during the October 12, 2004 meeting of the Western Pacific Regional Fishery Management Council's Social Science Research Committee. Attendees discussed the increasing importance of scientific information on recreational fishing and its application to state and federal management. However, many present did not have a good understanding of the information collected by the Hawaii Marine Recreational Fishing Survey (HMRFS) and how NOAA Fisheries develops catch estimates using data from the household telephone survey and shoreline and dockside field surveys. Committee members had other questions related to the HMRFS, its analyses, and data products.

The purpose of the workshop was to reach a common understanding of HMRFS data and procedures, learn how catch estimates are developed, and explore existing and potential applications of the data. The workshop was attended by about 20 people, including the Council Chairman, PIFSC's Science Director and Fisheries Monitoring and Socioeconomics Division Chief, Pacific Islands Regional Office Administrator, and State Division of Aquatic Resources Acting Chief.

Following the workshop, Bartlett and Allen presented a workshop summary to the Council's Scientific and Statistical Committee on February 23, 2005. Allen then presented a policy-level summary to the Council at its 126th meeting on March 16 and a summary and pelagics overview to the Pelagics Plan Team on May 4. At the workshop and each of these presentations, attendees raised several questions, identified issues, and made a number of recommendations about HMRFS procedures, analyses, and uses of the data.

This report has three main objectives:

- 1) Familiarize agencies and interested stakeholders with HMRFS procedures and data, using calendar year 2003 as an example;
- 2) Expand the utility of HMRFS survey results by demonstrating the types of analyses that are possible, but not routinely conducted; and
- 3) Suggest technical and procedural adaptations for conducting and analyzing HMRFS to facilitate regional applications, including recommendations by workshop and presentation attendees.

It is the authors' hope that this report serves as a platform for interagency and stakeholder discussion about HMRFS as it evolves to enhance its ability to provide useful information on recreational fishing in Hawaii. Please note that this report was developed prior to the 2006 publication of the National Research Council's (2006) Review of Recreational Fisheries Survey Methods (available at <http://www.nap.edu/catalog/11616.html>), so we did not address or respond to any of that report's findings.

This report begins with an overview of the MRFSS program before discussing the procedures and 2003 results of the telephone survey and field intercept survey. Next, we review how the MRFS program uses these data sets to develop estimates of recreational catch in Hawaii. The final section presents and discusses a variety of recommendations for future HMRFS efforts.

PROGRAM OVERVIEW

The National Marine Recreational Fisheries Statistics Survey was designed to develop statewide, annual estimates of catch by species. This is accomplished by three separate but complementary surveys:

- 1) The Coastal Household Telephone Survey (CHTS) collects information on shore and private/rental boat fishing effort;
- 2) The Access-Point Intercept Survey (Field Survey) collects catch data from shore, private/rental boat and charter anglers; and
- 3) The For-Hire Survey (FHS) collects effort data from charter captains about trips they took for hire.

Data from the three surveys are combined to produce estimates of fishing effort, catch, and participation. NOAA Fisheries contracts with the State of Hawaii's Division of Aquatic Resources (HDAR) to conduct the field surveys; the telephone household surveys are coordinated at the national level and conducted by a single contractor. The surveys have received Office of Management and Budget approval as required by the Paperwork Reduction Act.

The HMRFS is the program run by HDAR and NOAA Fisheries to estimate recreational landings for Hawaii. Although the survey was conducted in Hawaii¹ during its first several years of operation (1979–1981), funding issues prevented the HMRFS from being conducted again until 2001. In 2001, telephone sampling began in Wave 2 (March/April), and field surveying began on Oahu, Maui, and Hawaii (Big Island). FHS did not begin until mid-2003, and charter estimates for Hawaii have not yet been produced. Molokai and Kauai were added to the field survey in 2004.

COASTAL HOUSEHOLD TELEPHONE SURVEY (CHTS)

The CHTS contacts approximately 360,000 households per year in coastal counties. In Hawaii, all counties are coastal. Appendix A contains the questionnaire used in Hawaii.

The CHTS is conducted by a NOAA Fisheries contractor. Using a random-digit dial sampling method, the survey collects data on residents' marine recreational fishing effort (not catch) using computer-assisted telephone interviewing (CATI). The year is divided into six 2-month sampling periods called "waves." The contractor contacts households during a 2-week dialing period at the end of each wave. Dialing always begins in the last week of the wave and continues into the first week of the following month.

While socioeconomic information is not collected as part of the base CHTS questionnaire, economic add-ons are conducted in one region each year. The economic add-on is a series of additional questions "added on" to the end of the base survey. Education, race and ethnicity, income, and questions about fishing behavior are included to help NOAA Fisheries better understand the socioeconomic characteristics of recreational anglers.

¹ In this report, Hawaii refers to the entire state; the island of Hawaii is called the Big Island or Hawaii County (except in tables where the unit of analysis is county). Note also that Oahu is equivalent to the City and County of Honolulu. Maui in this report can refer either to the island or to Maui County (which also includes the Island of Lanai and most of the Island of Molokai), depending on the specific context.

Methods and Procedures

Telephone sample sizes by county for Hawaii were set in 2001 and have remained consistent through 2004 (Table 1).

Table 1.--Sample by county for Hawaii (number of households).

Island/County	Wave	Year
Big Island	600	3600
Maui	661	3966
Oahu	600	3600
Kauai	339	2034
Total	2,200	13,200

The CHTS employs a tiered screening process. The survey has a screening question to filter out non-permanent residents, defined as those living in their residence fewer than 6 months of the year. First, nonfishing households are identified as those in which the respondent says that no member of the household fished during the past 2 months; these households are not asked further questions. Basic data (household size, county/island of residence) for these households are stored by county in the nonfishing household file database. Fishing households become a part of the household data file (Type 1), which includes the above information, as well as number of anglers and a unique household identifier that can be used to reference the household in the additional data files.

The angler data file (Type 2) contains data on saltwater anglers who have fished in the last 2 months. This includes, but is not limited to, the number of saltwater anglers who have fished in the last 2 months, number of days fished in the last 2 months, whether all the anglers in the household took their trips together, and the angler's fishing category. Fishing category data are collected in Hawaii only and will be discussed later in this report.

Finally, information on all recreational trips profiled by 2-month anglers is stored in the trip data file (Type 3). Trip profiling obtains data on date of trip, island and county of return, mode of trip, fishing method, and target species (the latter data are also only collected in Hawaii).

For the purposes of this project, we reviewed the raw data files from 2003.² All references, tables, and charts in this report refer to the raw data files, or the sample, obtained during 2003 data collection.

² Since the survey began in Wave 2, 2001, and there were contractor issues with telephone data collection in Waves 2-4, 2002, this was the first opportunity for a full year's review.

Household Characteristics

In 2003, out of the 13,200 households sampled, the CHTS identified 1437 fishing households in the State of Hawaii for an overall angling incidence of 11% (Table 2). Household anglers who were identified as full-time or part-time commercial anglers are included in this data file, so the households in Table 2 include commercial fishing households.

Table 2.--Incidence of fishing households by county, 2003.

Island/County	Fishing HHs	% Fishing HHs
Hawaii	461	13%
Maui	465	12%
Honolulu	235	7%
Kauai	276	13%
Totals	1437	11%

Angler Characteristics

More than 2200 2-month anglers were identified within these households. Following the pattern of households across the counties (Table 2), the majority of 2-month anglers in the sample resided in Hawaii County, followed by Maui, Kauai and Honolulu County.

Fisherman categorization questions are asked of all identified 2-month Hawaii anglers. These questions are designed to place Hawaii anglers into one of four distinct categories:

- 1) Purely recreational anglers are defined as those who never sell any of their catch;
- 2) Recreational expense anglers are defined as those who sometimes sell fish, presumably to help cover trip expenses;
- 3) Part-time commercial anglers are defined as those who regularly sell fish to pay living expenses but do not consider themselves full-time commercial anglers; and
- 4) Full-time commercial anglers are defined as those who sell fish to pay living expenses and consider themselves to be full-time commercial anglers.

All trips by recreational and recreational expense anglers are included in the raw data and estimates, as well as trips by part-time commercial anglers in which catch was not sold. Trips by full-time commercial anglers are not used to develop estimates and are not included in the raw trip data file. However, commercial anglers are retained in the household data file, as noted earlier (Table 2).

In 2003, 90% of 2-month anglers said they were purely recreational, 8% said they were recreational expense (almost half were Big Island residents), 1% identified themselves as part-time commercial (almost half were Big Island residents), and the remaining 1% said they were full-time commercial anglers (most, 21 out of 25, were Kauai residents).³

Trip Characteristics

More than 17,000 trips were reported by 2-month Hawaii anglers in 2003. Approximately 4200 trips were profiled. The majority of profiled trips were shore trips (75%), followed by private boat (23%) and charter (2%). Slightly less than 8% of profiled trips were taken by part-time commercial anglers. Catch was sold on 20% of these trips, the vast majority in private boat mode.⁴

Values for the remaining trips (approx. 13,600) not profiled were imputed using a technique called “hot” imputation. Data from previously profiled trips, anglers or households were used to impute values for remaining trips not profiled, anglers not interviewed or households not contacted. This resulted in trip-level imputation for 92% of imputed cases, angler-level imputation for 5% of cases, and household-level imputation for 3% of cases. Mode is the key variable imputed based on trips already profiled; in other words, the main assumption is that the unprofiled trips were either shoreline, private boat or charter trips, based on the mode used on the profiled trips. The following description provides results by island.

Big Island Residents

Big Island residents sampled during the CHTS reported taking 5515 trips in 2003, and profiled 26% of them (1414). Eighty-six percent of these trips were taken on the Big Island. The remaining trips taken were distributed across other islands, with the two most common being Molokai (8%) and Kauai (4%). Seventy-two percent of the trips profiled were shore trips. Most were rod and reel trips (84%), and the second most common fishing method was spear (8%). Among the remaining trips, 27% were private boat trips and 2% were charter. Top fishing methods for private boats were trolling (67%), followed by casting (9%) and handlining (9%).⁵

Maui County Residents

Maui County residents sampled during the CHTS reported taking 4657 trips in 2003, and profiled 26% of them (1206). The vast majority of these trips were taken in Maui County.⁶ The top alternate location for remaining trips was the Big Island (4%). Seventy-

³ A much greater proportion of the commercial anglers used private boats as their fishing mode; see field survey results for the proportion found in that survey.

⁴ Because 90% of the anglers contacted reported never selling their catch, this suggests that the other 10% took 20% of the trips.

⁵ The target species for handlining was not asked.

⁶ Although island of fishing is not known for trips taken in 2003/2004, these data are being collected for 2005.

four percent of the trips profiled were shore trips, most (72%) using rod and reel, followed by spear (16%). This was the highest proportion of spear fishing trips in all Hawaii counties, followed closely by Kauai residents. Among the remaining trips, 24% were private boat trips and 2% were charter. Top fishing methods for private boats were trolling (65%), followed by bottomfishing (15%).

Honolulu County (Oahu) Residents

Oahu residents sampled during the CHTS reported taking 2987 trips, and profiled almost a quarter of them (716). Seventy-five percent of profiled trips occurred in Honolulu County, 18% on the Big Island and 6% in Maui County. Almost 80% of these trips were shore trips (the highest of all Hawaiian counties) and used predominantly rod and reel (86%), followed by spear (12%). Seventeen percent of the remaining trips were private boats, using trolling (65%) and bottomfishing (15%).

Kauai County Residents

Kauai residents sampled during the CHTS reported taking 4529 trips and profiled 19% of them (867). The vast majority (89%) of these trips were taken on Kauai, followed by 7% on the Big Island. Seventy-four percent of profiled trips were taken on shore, while 24% were taken by private boats. The top shore fishing methods were rod and reel (86%), followed by spearfishing (15%); top private boat methods were trolling (68%), followed by casting (9%).

Target Species

Target species is asked for every trip taken by a Hawaii resident; up to four target species are recorded. The telephone survey employs a list of 63 possible targets and an option for “No particular target,” “Don’t Know” and “Refused.” Hawaiian names and common names are both used for a number of species, and general categories like “Tunas,” “Billfish,” or “A’u” are also included. For these reasons, the target question does not always yield a species-level response, but rather a general target such as tuna.

Target species data were difficult to analyze for a number of reasons. First, CATI codes for the target variables were not converted to either the 8-digit MRFSS species codes or the state’s three-digit species codes. In addition, certain CATI codes had to be grouped to combine responses for both the common name and the Hawaiian name for a number of species (ono and wahoo, for example). Since the categories were not mutually exclusive, it was also hard to look at any species totals. For example, totals for yellowfin or bigeye could not be complete without considering the general category of “ahi,” or even “tunas.” Finally, with no post-coding of verbatim responses, there were hundreds of specified targets that had yet to be categorized.

To more easily observe the frequency of common targets for the purposes of this project, general species “groups” were created using the commercial license species subtype list.⁷ Jack, Other Inshore, Tuna, Billfish, Other Pelagic, Bottom, and None were used as new variables to group species. CATI responses were grouped as follows:

Jack	Other Inshore				Bottom
Amberjack	A'awa	Hinalea	Moi	Palani	Deep water bottomfish
Omilu	Aholehole	Ina	Mu	Parrot fish	Ehu
Papio	Akule	Kaku	Nabeta	Reef fish	Gindai
Ulua	Barracuda	Kumu	Nehu	Ta'ape	Hapu'upu'u
	Bonefish	Malu	Oama	Tako	Onaga
	Convict tang	Manini	Oio	Uhu	Opakapaka
	Goatfish	Menpachi	Opelu	Weke	Sea bass
	Hahalalu	Moana	Opihi		

Tuna	Billfish	Other Pelagic
Ahi	A'u	Mahi
Aku	Billfish	Moonfish
Albacore	Blue marlin	Ono
Bigeye tuna	Marlin	Opah
Kawakawa	Sailfish	Wahoo
Skipjack	Spearfish	
Tombo	Striped marlin	
Tunas		
Yellowfin		

Less than half (48%) of all trips profiled in 2003 were reported as having a specified target (Fig. 1). Almost 3700 responses were given for the target question. Shore mode trips were much less likely to have a specific target stated by the angler.

Overall, Jacks were the largest target group specified by anglers, followed closely by Other Inshore. Taken together, these two groups account for more than 40% of responses. Tunas were third, making up 9% of responses. Among private boats, Other Pelagics and Tunas both accounted for 21% of responses, followed by Billfish with 12%.

⁷ Responses to HI_TARG1, HI_TARG2, HI_TARG3, HI_TARG4 were all considered; therefore, there could be multiple responses for one trip. Easily identifiable targets under HI_TARGO (the verbatim response) were added to the above groups using simple substring commands. These were usually cases of interviewer error where the interviewer wrote in a response when they should have selected a species/group from the list. Ultimately, every target was not counted since the project schedule did not allow for the complete coding of every verbatim response.

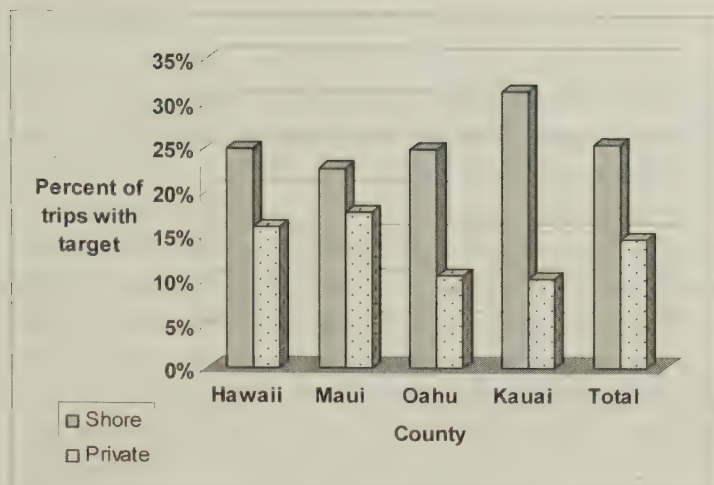


Figure 1.--Percentage of profiled fishing trips with specified target species, by county and trip mode, 2003.

FIELD SURVEY

Methods and Procedures

Data from the field survey, also called the angler intercept survey, are used to provide detailed information on catch by species. NOAA Fisheries contracts with HDAR to conduct the field survey. NOAA provides a target sample size desired for each island where field surveying is being conducted (in 2003, these were Oahu, Maui, and the Big Island; Molokai and Kauai were added in 2004), for each mode of fishing (shoreline, private boat, charter boat), and for each wave (the year is divided into six 2-month waves).⁸

HDAR meets the target sample sizes using a stratified random sampling method to give its field interviewers assignments for a given month. An assignment is a combination of a day type (weekday/weekend), site, and mode. Interviews are conducted when recreational anglers are most likely to be encountered. Generally, field hours can be defined as sunrise to sunset. Although specific dates are assigned, interviewers are allowed to substitute days of the same type as long as no consistent deviations are made over time. Docks, harbors, boat ramps and other areas where fishermen return from their trips are oversampled to yield a larger number of private boat trips, ensuring adequate representation of fishermen fishing in federal waters. Sites with little known use are included in the sample, but interviewers encountering no fishermen at such a site can proceed to an alternate, similar site.

⁸ The Intercept Interviewer Procedures Manual for the 2001 Hawaii Marine Recreational Fishery Survey (HMRFS) specifies that "The Cooperative Agreement between NMFS and HDAR sets an annual sample size target of 390 intercept interviews for charter boats and 1,260 for private boats. Currently these sample targets are set evenly across waves, since there is a lack of historical data that could be used to better allocate the sample. Distributions by island (Oahu, Hawaii and Maui) will be determined as interviewers are hired and according to preliminary data obtained through the telephone and intercept surveys."

During 2003, HDAR had 11 interviewers in the field, a data processor, and a project manager. The manager is responsible for hiring, training, and supervising the interviewers, reviewing the data and sending it to NOAA Fisheries by the due date. Interviewers are hired to work on each island. New interviewers receive training, and each season, existing interviewers receive a refresher session.

Once at the site, interviewers administer the survey (contained in Appendix B) to the fishermen encountered, including measuring any whole fish that are available. Data are recorded on the survey form. Although NOAA uses data only from recreational fishermen (defined later), the interviewers continue and attempt to complete the interview even for commercial fishermen encountered.⁹ The interviewers typically offer the respondent a gift of appreciation for participating in the interview, such as a ball cap or t-shirt.

After an assignment is completed, interviewers complete an assignment summary form, which includes information about the hours worked, miles traveled, any anomalies encountered, and whether an alternate site was sampled instead of the assigned site (along with the reason for the substitution, selected from a list of possible reasons). Interviewers call in weekly tallies of their assignments as well as provide the completed forms for each week. The data are entered and verified by an HDAR data processor and then reviewed by the HDAR project manager.

Three databases are created: the Type 1 database contains information about the angler and trip; the Type 2 database contains information about unobservable catch; and the Type 3 database contains information about observed catch.¹⁰ The HDAR project manager sends the databases to NOAA Fisheries every 2 months (after each wave is completed). An extensive training manual contains the protocol for conducting and processing the field surveys; the contract specifies products and timelines for delivering the data to NOAA Fisheries.

NOAA Fisheries takes the relevant data from each database and then runs the program that estimates catch by island and mode for each wave. At the end of the year the wave estimates are aggregated to produce the annual estimate.

⁹ NOAA purges the database of commercial anglers, so comparisons between recreational and commercial fishermen encountered at the same sites are never made even though these data are available in the raw data files.

¹⁰ Unobserved catch includes fish that are not available whole to measure. This could include fish caught and then used as bait, fish that have been filleted, fish released live or dead, and fish that the fisherman refuses to show the interviewer.

2003 Sample

During 2003, the field team interviewed 2810 fishermen: 1160 (41%) on Maui; 988 (35%) on the Big Island, and 658 (23%) on Oahu. Forty-four percent were interviewed upon returning from a private boat trip, 23% after returning from a charter boat trip (all on the Big Island or Maui)¹¹, and 33% while shoreline fishing (22% were fishing from a beach, cliff, or other natural shoreline while 11% were fishing from a manmade shoreline such as a dock or jetty). Figure 2 shows the number of fishermen interviewed for each island and fishing mode.

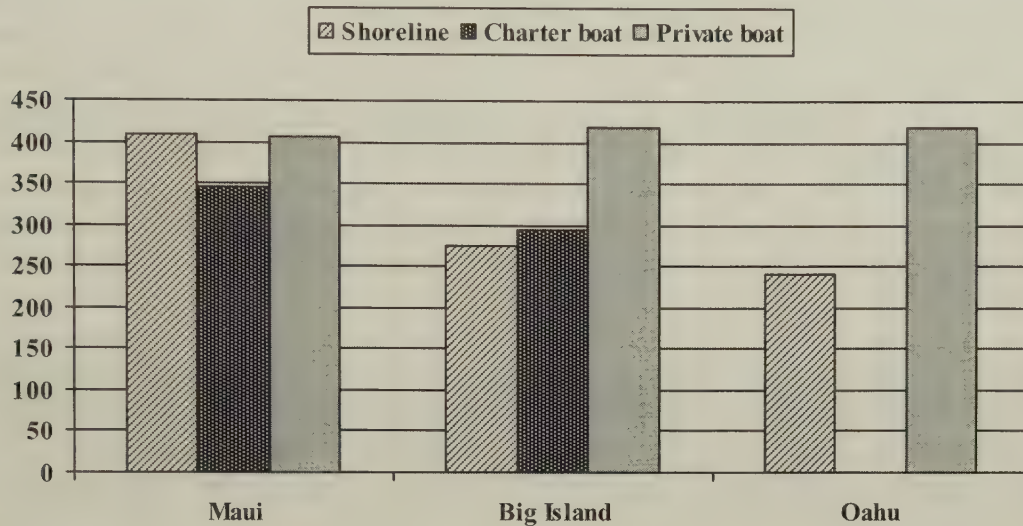


Figure 2.--Number of HMRFS interviews, by island and trip mode, 2003.

One or more interviews were conducted at 31 sites on the Big Island, 11 sites on Maui, and 34 sites on Oahu. Table 3 shows the sites where most of the interviews were conducted on each island, along with the proportion of interviews conducted at each site. Sites where only a few anglers were interviewed are not displayed.

¹¹ In 2003, charter boat operators on Oahu (primarily based at Kewalo Basin) did not participate in the HMRFS charter boat survey.

Table 3.--Proportion of fishermen interviewed at major sites, by island.

Big Island Interview Sites (988 fishermen)	
Site:	Percent (%) Interviewed at Site
Honokohau boat ramp	26
Honokohau Harbor charter slips/fuel dock	23
Keahou boat ramp	10
Hilo Harbor boat ramp (some shoreline fishermen)	8
Kawaihae boat ramp (some shoreline fishermen)	6
Hilo Bay break wall	4
Coconut Island/Banyan Drive	4
Maui Interview Sites (1160 fishermen)	
Mala Wharf (Lahaina)	26
Lahaina	22
Kahului	14
Maalaea (Wailuku)	11
Kihei	9
Olowalu	9
Oahu Interview Sites (658 fishermen)	
Waianae Harbor	28
Haleiwa	17
Maunalua Bay and Beach Park	12
Heeia (Kaneohe)	12
Keehi Lagoon	6
Electric Beach park	4

The precise rate of response is not calculated; interviewers note the number of refusals on a daily form, but that information is not entered into any database. Very few fishermen, estimated to be no more than 5–10%, refuse to be interviewed. Of those who consented to the interview, question response was excellent: 64% completed the entire survey; 35% did not complete one or more non-key items; and less than 1% did not complete a key item. Another indicator of good cooperation was that 66% of the fishermen provided their names and phone numbers when requested to allow the project manager to verify the interview.

Description of the Fisherman

Most of the fishermen (80%) were Hawaii residents, along with 6% from California and 1% each from Texas, Illinois, and Washington. The survey does not collect other demographic information such as gender, ethnicity, age, education or income, or years lived in Hawaii. The only useable locator information is zip code, which allows spatial analysis of fishermen's residences.¹²

¹² Spatial analysis was not done as part of this project.

Some of the questions are tailored to meet Hawaii needs as defined by HDAR and NOAA staff. As in the phone survey, there is a set of questions that attempts to categorize fishermen as recreational or commercial. In Hawaii (and probably other regions as well) it can be difficult to characterize fishermen as recreational, commercial, or subsistence. A fisherman may take some commercial trips and some recreational trips. Some fishermen may occasionally sell fish to help cover expenses. Some fishermen may never sell their catch. These questions on commercial status are also necessary for the NOAA catch estimates, which are designed to be recreational catch only. HDAR completes interviews for every fisherman encountered, but people identifying themselves as commercial fishermen are dropped from the catch estimates computed by NOAA. Analysis of the raw data will later reveal significant differences between commercial and noncommercial (recreational) fishermen, including days per year fished, species caught, and pounds landed.

To assess their status, fishermen were first asked if they ever sell any fish they catch. Eighty-nine percent (2483 fishermen) said they never sell fish; these are considered to be “purely recreational” fishermen. Eight percent (225 fishermen) said they have sold fish to cover fishing expenses; these are considered to be “recreational expense” fishermen and their catch is included in HMRFS catch estimates. Three percent (92 fishermen) said they have sold fish for income; these fishermen are considered to be commercial fishermen, who are excluded from the sample used to develop recreational catch estimates. Of these 92, just more than half (58%) considered themselves to be full-time commercial fishermen, while the rest said they were not. Note that this variable is measured at the angler level, not the trip level.¹³ A separate question asked fishermen about the disposition of their catch on that specific trip.

For the total sample, the distribution of recreational/commercial status was very close to that found in the household telephone survey (90% “pure recreational,” 8% “expense recreational,” 2% commercial) even though private boaters were oversampled on the field survey but not on the telephone survey. These results were different depending on fishermen’s mode (Fig. 4). Nearly all of the charter boat fishermen (just under 100%) said they never sell fish. Of the shoreline fishermen, 97% said they never sell fish, 2% said they sell sometimes to cover expenses, and just over 1% said they sell fish for income. Of the private boat fishermen, 77% said they never sell fish, 16% said they sell sometimes to cover expenses, and just over 6% said they sell fish for income.

The proportion for private boat fishermen differs from that found by Hamilton and Huffman (1997), in their study of Hawaii’s small boat pelagic fishery in 1995–96. They obtained responses from 569 fishermen (340 on Oahu, 112 on the Big Island, 56 on Kauai, 48 on Maui, and 13 on Molokai and Lanai combined), with most interviews conducted between April and August 1996. The three interviewers sampled boat harbors on every island “with the intent of intercepting the maximum number of fishermen on any given day.” They found that 32% of the fishermen reported selling at least some fish within the past 12 months and said they had sold fish to earn income. Another 40% reported having sold fish, but “only to cover

¹³ Of those who said they had sold fish, the vast majority (281) were on fishing trips on private boats. In Hawaii, people fishing on charter boats typically do not keep their catch, which becomes the property of the captain.

trip costs.” Just 28% said they had not sold any fish in the past 12 months.¹⁴ This differs from the 77% of purely recreational private boat anglers encountered in the 2003 HMRFS field survey.

One reason the 1995–96 study sampling design resulted in more encounters with commercial anglers could be because its goal was to maximize sample size and they sampled at fewer (more commonly used) sites. However, there could be other explanations as well. Analysis of HMRFS data over time will allow us to assess the variability of fishermen across recreational/commercial categories.

When asked how many days they had fished in Hawaii over the past 12 months, responses of Hawaii residents differed by recreational/commercial status (Table 4).¹⁵ While the average number of days fished was 55, commercial fishermen reported fishing almost every other day (151 days over the last year). Note that in Table 4, the means (arithmetic average) are higher than the medians (the number above and below which half of the numbers fall), indicating a skewed distribution. For example, a few fishermen who fish a great many days a year can “pull up” the mean for the entire sample, but their high level of use would not have a comparable effect on the median.

Table 4.--Average number of days fished in Hawaii over last 12 months (Hawaii residents only).

	Mean # days	Median # days
Total sample	55	40
Pure Recreational	48	30
Recreational Expense	74	52
Commercial	151	130

Description of the Current Trip

The most common gear used was rod and reel, the method identified by 91% of the fishermen. The next most common gear was spear (used by 4%), handline (2%), and hand pole or throw net (1% each). Other methods named by a few people included scoop net, gill net, crab net, surround net, and simply “hand.” Fishermen using rod and reel gear were asked about their fishing method; 59% reported trolling, 32% casting, 7% bottomfishing and handlining. There is an obvious relationship between fishing mode and gear; 76% of the Hawaii resident private boaters who reported using rod and reel said they were trolling, and 16% bottomfishing.

¹⁴ In Hamilton and Huffman (1997), the proportion of commercial fishermen encountered varied by island, with the largest proportion (60% of those with completed interviews) on the Big Island and the smallest proportion on Oahu and Maui (25%) and the other islands in between (29% on Kauai, and 31% on Molokai/Lanai). Full-time commercial operators took more trips in the previous year (mean 158) than part-time commercial fishermen (86), expense fishermen (58), and recreational fishermen (36). They also caught more fish.

¹⁵ Non-residents were not included in this analysis because most fished in Hawaii on their current (one) trip.

People who reported bottomfishing were asked for additional details. Just over half (51%) reported fishing shallow water (defined as less than 20 fathoms) while 33% said they were deepwater fishing (greater than 20 fathoms). An additional 14% reported using a tuna handline, showing that some anglers believed the initial question's use of "bottomfishing" was referring to fishing depth rather than a type of fish. This is a common issue with use and interpretation of Hawaii names for fishing methods and gear.

Shoreline fishermen's trips had lasted about 4 hours so far (at the time of the interview), with fishermen reporting they planned to stay about 1 more hour. Charter boat and private boat fishermen reported slightly longer trips, an average of 6.2 hours for charter and 6.4 hours for private boats.

Of the fishermen on private boats, 36% reported fishing primarily in state waters (within 3 miles of shore); 2% said they used one of the State's fish aggregation devices (FAD) while fishing. Private boat fishermen who said they fished primarily in federal waters (64%) were much more likely to report having used a FAD (48%).

Of the fishermen on charter boats, 23% reported fishing primarily in state waters (within 3 miles of shore); 1% said they used one of the State's FADs while fishing. Charter boat fishermen who said they fished primarily in federal waters (77%) were much more likely to report having used a FAD (43%).¹⁶

Description of Catch

Nearly everyone (98%) said they were fishing for finfish, not surprising given that these are the target sample for the field survey. However, 78% said they were not targeting any particular species. Just under half (43%) reported catching one or more finfish on this trip.¹⁷ Success was related to fisherman category; 70% of the recreational expense and commercial fishermen reported catching one or more finfish, compared to 40% of the purely recreational fishermen. Interestingly, the latter rate was very consistent across fishing mode, varying only from 36 to 48% success for shoreline (whether natural or developed area), charter boat, and private boat.

A total of 6161 fish representing 88 species were available to be seen whole by the interviewer. The highest number of these (24%) were aweoweo, caught by nine fishermen in an exceptional run in August, 2003. One fisherman alone caught an estimated 1000 fish in 6 hours. This demonstrates how much the data can be affected by a single event during the year, so caution is warranted in extrapolating from the raw data. However, it also shows that the survey procedures are capable of capturing such unique events.

¹⁶ Note that for the onsite survey, the clients on charter boats are being interviewed, not the captain.

¹⁷ Fishermen using a boat were almost always interviewed as they arrived back on shore, so the amount caught was known. Shoreline fishermen could have been interviewed at any point during their trip, so they could only report what they had caught so far and estimate how much longer they were planning to fish.

The next highest number of fish (13%) were aku (skipjack tuna), followed by ahi (yellowfin tuna; 8%), mahimahi (7%), ono (5%), yelloweye kole and peacock razorfish (4% each), and 2–3% each of Baldwin's wrasse, yellowstrip goatfish (weke a a), bigeye scad (akule), bluesripe snapper (taape), convict tang (manini), and pink snapper (opakapaka).

A total of 2766 fish representing 95 species were not available whole to be seen by the interviewer. Thirteen percent were aku, 9% ahi, 7% akule, 6% each of aholehole and weke a a , 5% each of opelu, mahi, and various razorfish, and 2% each of yelloweye kole, nenu, nenue (highfin rudderfish), ala ihi (squirrelfish family), laenihi, and opakapaka.

Obviously, fishing mode affects catch composition and number, as does angler status (recreational/commercial). A more accurate picture emerges if we describe catch only for Hawaii residents who fish from private boats, the population of greatest interest to federal managers because many fish regularly in federal waters. This subsample (Hawaii residents fishing from private boats) had 3322 fish available whole to be seen by the interviewer; 1461 were caught by commercial fishermen and 1861 by recreational fishermen. The fish represented 53 species, with 11 species caught by commercial fishermen and all 53 caught by recreational fishermen. Table 5 shows the species of observed fish and the composition of the commercial and recreational catch. The less diverse composition of the commercial catch, 70% of which was opelu, reflects the targeting of commercial species. In contrast, the highest proportion of the recreational catch among private boaters was 26% (aku).

Table 5.--Observed fish: species composition of commercial and recreational catch by Hawaii resident fishermen fishing from private boats.

Species:	Commercial fishermen (%)	Recreational fishermen (%)
Opelu	70	4
Aku	16	26
Ahi (yellowfin)	4	11
Ono	2	9
Yelloweye kole	0	7
Baldwin's wrasse	0	7
Peacock razorfish	0	6
Mahi	1	5

Regarding fish that were not observed, Hawaii residents fishing from private boats reported catching 1611 fish; 298 fish were caught by commercial fishermen and 1313 fish by recreational fishermen. The unobserved fish represented 46 species, with 8 species caught by commercial fishermen and 45 caught by recreational fishermen. Table 6 shows the species of unobserved fish and the composition of the commercial and recreational catch. The less diverse composition of the unobserved commercial catch reflects the targeting of commercial species. However, the same two species (aku and ahi) constituted the greatest proportion of the unobserved catch of both recreational and commercial fishermen.

Table 6.--Unobserved fish: species composition of commercial and recreational catch by Hawaii resident fishermen fishing from private boats.

Species:	Commercial fishermen (%)	Recreational fishermen (%)
Aku	27	19
Ahi (yellowfin)	25	12
Ala ihi (squirrelfish)	21	0
Opakapaka	11	1
Opelu	13	8
Mahi	2	6
Ono	0	5
Peacock razorfish	0	5

DEVELOPMENT OF RECREATIONAL CATCH ESTIMATES

The NMFS Office of Science and Technology develops annual, statewide estimates of recreational landings in Hawaii by combining data from the two independent, but complementary, surveys.¹⁸ This section will provide a *simplified* illustration of how landings estimates are generated using data from the U.S. Census, the CHTS and the Access-Point Intercept Survey (known as HMRFS in Hawaii).¹⁹

Effort Estimates

This example illustrates how Hawaii landing estimates are calculated for observed ono (wahoo) catch in Wave 4, 2003. It begins with the CHTS, the random digit dial survey that was conducted in the first 2 weeks of September. The CHTS is used to generate the mean number of trips per household. Households are sampled by county. The type of fishing, or mode, is collected for each reported trip.

In total, 2228 households were contacted during Wave 4 (July–August), 2003. Fishermen in contacted households reported taking 3750 shore trips, 31 charter trips and 656 private boat trips, for a total of 4437 trips during the 2-month period.

An estimated mean number of fishing trips per household by mode is generated by dividing the number of trips in each mode by the total number of households contacted. For example, in Table 7, 80 private boat trips were reported by fishermen living in Honolulu County (Column 5). This is divided by the 609 total households contacted in Honolulu County (Column 3), for a mean of 1,314 private boat trips/household in Honolulu County

¹⁸ Future plans call for charter estimates to be generated from the For-Hire Survey. Participation problems in Kewalo Basin, Oahu precluded NOAA Fisheries from using these estimates in 2003–2004.

¹⁹ For a more detailed description of estimation procedures, visit:

<http://www.st.nmfs.gov/st1/recreational/index.html> and click on “Program Overview.”

(Column 6). This estimate is then multiplied by the total number of residential households in Honolulu County, 286,450 (Column 2), for that time period to obtain the estimated total trips by coastal residents with phones; in this case, 37,640 (Column 7). This process is repeated for each county/mode combination. Totalling the estimated number of trips for all counties by mode (Column 7) yields an estimate of 463,572 shoreline fishing trips, 6,079 charter trips, and 79,675 private boat trips.

Table 7.--Number of fishing trips per household, by county.

Coastal county	Number of residential households [U.S. census]	Number of residential households contacted	Reported mode of fishing	Trips reported by residents of contacted households	Estimated mean number of fishing trips per household ²⁰	Estimated total trips by coastal residents [with phones]
Honolulu	286,450	609	Shore	515	0.846	242,222
			Charter	10	0.016	4,698
			Private	80	0.131	37,640
Hawaii	52,985	601	Shore	865	1.439	76,261
			Charter	1	0.002	90
			Private	240	0.399	21,157
Maui	43,622	676	Shore	950	1.405	61,289
			Charter	20	0.029	1,291
			Private	190	0.281	12,262
Kauai	20,183	342	Shore	1420	4.152	83,800
			Charter	0	0	0
			Private	146	0.427	8,616

The telephone survey does not cover all trips encountered in the field. The field survey helps correct for households excluded from the telephone survey universe, namely, households without phones. The proportion of people without a phone is estimated using the field survey. Each intercepted angler is asked for their state of residence and whether their home has a "landline telephone" (Appendix B, Question 23). These data are used to develop a ratio of total trips intercepted by mode for Hawaii residents with phones.

As illustrated in Table 8, HDAR intercepted and interviewed fishermen taking 240 private boat trips in Wave 4, 2003 (Column 2). Of these 240 intercepts, 214 were with Hawaii residents with phones (Column 3). Dividing the latter by the total number of intercepts in this mode, we estimate a ratio of 1.121 (Column 4). This is applied to the

²⁰ In this and the following tables, the calculations are based on the original percentages, which went out to 9 decimal points. However, for brevity we rounded off the percentages to 3 decimal points, so the resulting numbers are only approximate. Also, in this table, the household count for Maui includes Kalawao County.

previous estimate calculated from the CHTS (Column 5), for an adjusted total of 89,356 estimated private boat trips in Wave 4, 2003 (Column 6).

Table 8.--Estimated total number of angler trips by mode of fishing.

Mode of fishing	Number of angler trips intercepted	Number of intercepted angler trips by HI residents [with phones]	Estimated ratio of total trips to trips by HI residents [with phones]	Estimated total number of fishing trips by HI residents [with phones]	Estimated total number of angler fishing trips
Shore	175	167	1.048	463,572	485,777
Charter	110	17	6.471	6,079	39,335
Private	240	214	1.121	79,675	89,356

Catch Estimates

The first component of the catch estimates is the division of angler trips by area. In the effort portion, the estimates are calculated by mode or type of fishing. For the catch portion, the estimates are calculated by area fished (inland, state/ocean less than 3 miles, federal/EEZ).²¹ Area fished is reported by fishermen during the field survey (Appendix B, Questions 13, 13a).

Table 9.--Total number of angler trips by area and mode of fishing.

Mode of fishing	Estimated total number of angler fishing trips	Number of angler trips intercepted	Primary area of fishing	Number of angler trips in given area	Estimated proportion of trips in given area	Estimated total angler trips in given area
Shore	485,777	184	Inland	32	0.174	84,477
			Ocean < 3	152	0.826	401,300
Private	89,356	261	Inland	24	0.092	8,212
			Ocean < 3	59	0.226	20,203
			Ocean > 3	178	0.682	60,941

Table 9 breaks out the total intercepts by mode and area (Columns 3 and 5). In this case, of the 261 intercepted private boat trips, 24 were taken in inland waters, 59 in ocean waters less than 3 miles from shore, and 178 in federal waters (ocean > 3). The estimated proportion of total private boat trips in federal waters is 0.682 (Column 6), or 178/261. This

²¹ Inland refers to fishing in bays or estuaries.

proportion is applied to the total effort (Column 2) to obtain the total in that mode and area, 60,941 (Column 7).

Once angler trips by area have been estimated, the mean harvested catch per trip can be calculated. As an example, the following tables present landings of ono (*Acanthocybium solandri*, also known as wahoo) collected through dockside interviews in Wave 4, 2003.

Table 10.--Mean number of harvested ono per trip for private boat mode, Wave 4, 2003.

Mode of fishing	Primary area of fishing	Angler trips intercepted	Angler trips with catch of ono	Number of harvested ono observed	Number of harvested ono reported [not observed]	Total number of harvested ono	Estimated mean number of harvested ono per angler trip
Private	Ocean < 3	59	28	32	28	60	1.017
	Ocean > 3	178	6	4	10	14	0.079

Of the 178 private boat trips in federal waters intercepted, only 6 had ono catch either observed or reported (Column 4). Four ono were directly observed by the interviewers (Column 5), while 10 were reported by the fishermen, but not observed (Column 6). The total number of harvested ono by area (Column 7) is divided by the total trips intercepted in that mode/area combination to estimate the mean number of ono harvested per angler trip. In this case, there were an estimated 0.0787 ono harvested per private boat angler trip in federal waters (Column 8).

Table 11.--Estimated number of ono harvested by private boat mode.

Mode of fishing	Primary area of fishing	Estimated total angler trips in given area	Estimated mean number of harvested species per angler trip	Estimated total fish harvested
Private	Ocean < 3	20,203	1.017	20,544
	Ocean > 3	60,941	0.079	4,796
	TOTAL	81,144		25,340

To obtain the total harvest for private boats, the mean ono harvest per angler trip (Column 4) is multiplied by the total angler trips in that area (Column 3). The total ono harvest for private boats in Wave 4, 2003 (Column 5) is estimated to be 25,340, obtained by adding the estimated harvests in the state and federal waters.

To obtain total ono harvest for Wave 4, 2003 estimates by mode can be added. To obtain total private boat harvest for Wave 4, 2003 estimates for all species can be added.

Precision of Estimates

The survey statistics are used to estimate characteristics of interest for the entire population of fishing trips in a specified category. Because the statistics are derived from samples of observed trips, each estimate will have a level of uncertainty associated with it. The standard error of an estimate is the measure of the variability of the estimate in relation to the true (unknown) value. Proportional standard error (PSE) is published on the NOAA Fisheries Web site for every effort and catch estimate for each wave/mode/area combination. PSE is expressed as (Standard Error/Estimate) * 100 and is useful when comparing the relative precision of two estimates (a higher PSE means lower precision). Assuming the sample estimates have a normal distribution, we can use the PSE values to estimate a 95% Confidence Interval (CI) for the true population value; this interval is expected to have a 95% chance of bracketing the true value of the characteristic of interest.

For example, in Table 12, the PSE for private boat ono harvest in the federal waters in Wave 4, 2003 is 45.4 (Column 6). Together with the point estimate (4,796 fish), the PSE enables us to estimate a CI for the total harvest. We show the 95% CI in Table 12. We are able to state with 95% confidence that this interval or range (290–9,842 fish) includes the true total ono harvest in this survey category. This is a big range, indicating a large degree of uncertainty in our point estimate of the ono harvest in this category (4,796 fish).

Because the standard error of a given estimate is inversely related to sample size, the PSE is decreased as sample size is increased. Thus when reviewing the Wave 4 estimate of total ono harvest by private boats in all ocean areas combined, we find that the PSE is almost half as large, 25.2. This is partly because the latter estimate is based on a combined 237 angler trips instead of the sample of 178 trips by boats that fished in federal waters.

Table 12.--Ono harvest and PSE, private boat mode, Wave 4, 2003.

Mode of fishing	Primary area of fishing	Estimated total angler trips in given area	Estimated mean number of harvested species per angler trip	Estimated total fish harvested	PSE	95% CI +/-
Private/Rental	Ocean < 3	20,203	1.017	20,544	29.3	11,814
	Ocean > 3	60,941	0.079	4,796	45.4	4,268
	TOTAL	81,144		26,776	25.2	13,225

Figure 3 shows that for all 2003 waves combined, the PSE for the estimate of total ono harvest was 16.²² This chart also demonstrates that in general the more common the species, the smaller the PSE tends to be, a direct effect of the frequency with which interviewers observe these species in the field. Management measures such as bag limits typically reduce the within-sample variability of number of fish caught and thereby tend to increase the precision of the estimate. In Hawaii, the sheer number of species observed, coupled with the

²² A PSE of 20 or less is generally considered acceptable in fisheries data.

absence of management measures that limit catch, like bag limits, contribute to high PSEs, especially for many nearshore species.



Figure 3.--PSE for common Hawaii species, Wave 4, 2003 and annual 2003.

Accessing Survey Results

Hawaii estimates can be accessed through the MRFSS program Web site at: <http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html>. Preliminary estimates are usually available 45 days after the conclusion of the wave (e.g., Wave 4 (July/Aug) should be available by mid-September), and annual estimates are usually finalized by April of the following year. Users of the Web site can access:

- Total estimated trips by mode and area
- Total estimated catch by species, mode and area
- PSE for each estimate

AHI CATCH AND RELATED INFORMATION, 2003

This section serves as an example of the types of analyses that can be conducted for a given species. Yellowfin tuna were fairly commonly caught in 2003, making such analyses reasonable. In 2003, HMRFS field surveyors encountered just one trip on which bigeye tuna were caught. The trip was taken in October out of Honokohau, with fishing conducted primarily in federal waters and not on a FAD. A recreational expense fisherman who fishes 125 days/year caught 10 bigeye (not measured) using a handline. Because just one trip with bigeye catch was reported, the ahi figures in this section refer to yellowfin tuna only.

In 2003, field interviewers encountered 84 trips on which a total of 503 yellowfin were caught. Table 13 shows information about the number of yellowfin caught, by area fished (federal/state waters) and angler type (pure recreational, recreational expense, and commercial). Of the total 503 yellowfin caught, 137 were caught by commercial fishermen (63 observed whole and 74 unavailable for observation). Recreational fishermen caught 366 yellowfin (206 observed whole and 160 unavailable for observation).

Forty-three percent of the anglers catching yellowfin were classified as pure recreational (who reported never selling fish), 35% as recreational expense (who have sold fish to cover expenses), and 22% as commercial fishermen (who have sold fish for income). Table 13 includes information about the commercial anglers encountered. Although their catch numbers are not incorporated into the Hawaii recreational catch estimates, they are still useful for comparison.

Table 13.--2003 HMRFS interview results for yellowfin, private boat fishing mode.

Angler type	Primary fishing area	Angler trips with yellowfin catch	Number of harvested yellowfin	Mean # yellowfin harvested per trip
Pure recreational	Federal waters	28	153	5.5
	State Waters	8	32	4
Recreational expense	Federal waters	27	170	6.3
	State waters	3	11	3.7
Total, all recreational	Federal waters	55	323	5.9
	State waters	11	43	3.9
Commercial	Federal waters	18	137	7.6
	State waters	0	na	na
Total recreational and commercial	Federal waters	73	460	6.3
Total recreational and commercial	State waters	11	43	4.1

Purely recreational and recreational expense fishermen were similar in choice of gear and fishing method; 94% of purely recreational fishermen and 86% of recreational expense fishermen reported trolling. Two purely recreational and four recreational expense fishermen reported handline as the gear type. Interviews indicate there was also little difference between the purely recreational and recreational expense groups in the amount of time spent fishing on the trip, although trips in state waters were shorter than trips in federal waters for both groups. Recreational expense fishermen reported fishing an average of 5.7 hours for trips primarily in state waters and 7.2 hours for trips primarily in federal waters, compared to purely recreational fishermen who spent 5.4 hours in state waters and 7.4 hours in federal waters.

The recreational expense fishermen reported fishing for more days over the past 12 months (average of 95 days) than did purely recreational fishermen (average of 51 days).

Table 14 provides additional information about only the recreational trips and the anglers. Most of the fishermen (86%) reporting yellowfin catch were interviewed on either Oahu or the Big Island. Nearly three-quarters (74%) were interviewed between March and August. A majority of the fishermen (70%) reported not having a target species on their trip. However, a greater proportion of the recreational expense fishermen (40%) than the purely recreational fishermen (22%) reported having a target species. Similarly, a greater proportion of the recreational expense fishermen (33%) than the purely recreational fishermen (14%) reported having yellowfin as a target species.

Table 14.--Survey statistics for recreational fishermen reporting yellowfin catch, 2003.

Characteristic	Number of pure recreational anglers (n = 36)	Percentage of pure recreational anglers (%)	Number of recreational expense anglers (n = 30)	Percentage of recreational expense anglers (%)	Total number of recreational anglers (n = 66)	Total percentage of recreational anglers (%)
Interviewed on Big Island	20	55	10	33	30	45
Interviewed on Maui	3	8	6	20	9	14
Interviewed on Oahu	13	36	14	47	27	41
Interviewed Wave 1	4	11	3	10	7	11
Interviewed Wave 2	11	31	9	30	20	30
Interviewed Wave 3	5	14	6	20	11	17
Interviewed Wave 4	11	31	7	23	18	27
Interviewed Wave 5	2	6	2	7	4	6
Interviewed Wave 6	3	8	3	10	6	9
Reported having any target species	8	22	12	40	20	30
Reported that target species was yellowfin	5	14	10	33	15	23
Reported using FAD	21	58	18	60	38	58

Table 15 shows that the majority of observable fish were not measured or weighed. Eight trips were encountered on which 10 or more yellowfin were caught and of these 3 trips had 25 or more yellowfin. The maximum number of fish per trip that were individually measured or weighed was 4, so many fish on multiple-fish trips were not measured and/or weighed. On 11 out of the 31 trips with observable yellowfin, no fish were weighed or measured.

Table 15.--Characteristics of observable yellowfin catch.

Characteristic	Purely recreational fishermen	Recreational expense fishermen	Total, All recreational fishermen
Number of Yellowfin Caught	92	114	206
Percent (%) of trips for which one or more fish were measured	22	46	32
Percent (%) of yellowfin caught that were measured	7	9	8
Average length of yellowfin	741 mm (<i>n</i> = 6 fish)	756 mm (<i>n</i> = 10 fish)	751 mm (16 fish)
Percent (%) of trips for which one or more fish were weighed	61	62	61
Percent (%) of yellowfin caught that were weighed	16	11	13
Average weight of yellowfin (kg)	17.6 (<i>n</i> = 15 fish)	10.1 (<i>n</i> = 12 fish)	14.3 (27 fish)

Looking at the issue in greater detail, we found that for the 18 trips made by anglers classified as purely recreational, weights of one or more yellowfin were obtained for 7 trips, both weight and length obtained for 4 trips, and neither obtained for 7 trips. For the 18 trips made by anglers classified as recreational-expense, weights of one or more yellowfin were obtained for 3 trips, both weight and length obtained for 5 trips, length only for 1 trip, and neither obtained for 4 trips.

Catch-per-unit-of-effort, Total Yellowfin Harvest

The total estimated number of angler trips from the CHTS for 2003 in private boat mode was 509,415. Using this effort estimate, catch-per-unit-of-effort and total harvest can be estimated using raw data from the field survey.

Table 16.--Trips by area, private boat mode, 2003.

Primary area of fishing	Number of angler trips in given area	Estimated proportion of trips in given area	Estimated total angler trips in given area
Ocean > 3	723	0.631	321,385
Ocean < 3	423	0.369	188,030
	1146		509,415

In Table 16, private boat trips have been divided by the specified area of fishing—EEZ and state waters. The number of angler trips in a designated area was estimated by multiplying the total number of trips by the estimated proportion in the area.

Table 17.--Estimated mean harvest of yellowfin by area, 2003.

Primary area of fishing	Number of angler trips intercepted	Number of harvested yellowfin observed or reported	Estimated mean number of harvested yellowfin per angler trip
Ocean > 3	723	320	0.443
Ocean < 3	423	41	0.097

Table 17 shows how the mean yellowfin harvest per angler trip for 2003 was calculated. First, the number of yellowfin observed or reported in private boat mode in 2003 was classified by fishing area. In this case, there were 320 yellowfin harvested in the EEZ and 41 in state waters. Then the number of yellowfin in each area was divided by the total number of angler trips in that area to estimate the mean number of harvested yellowfin per trip, i.e., 0.4426 yellowfin per trip for private boat angler trips in the EEZ and 0.0969 yellowfin per trip for private boat trips in state waters.

Finally, Table 18 shows how the information from Tables 16 and 17 was combined to estimate the total number of yellowfin harvested in private boat mode in 2003 — 160,470 fish.

Table 18.--Estimated total yellowfin harvest, private boat mode, 2003.

Primary Area of Fishing	Estimated Total Angler Trips in Given Area	Estimated Mean Number of Harvested Yellowfin per Angler Trip	Estimated Number of Yellowfin Harvested
Ocean > 3	321,385	0.443	142,245
Ocean < 3	188,030	0.097	18,225
TOTAL	509,415		160,470

CONCLUSIONS AND TECHNICAL RECOMMENDATIONS

The HMRFS was developed to produce annual, statewide catch estimates of finfish by species, mode (shoreline, charter boat, private/rental boat), and area (state waters within 3 miles of shore and federal waters greater than 3 miles from shore). To ensure consistency with catch and effort estimates made for other coastal states, the same methodology is used nationwide. The survey program meets some state and local needs, particularly through questions that were added and modified based on Hawaii information needs.

However, the data collection effort is not designed to develop estimates that could be used for managing fisheries by island or region, or for seasonal adjustments. In addition, many useful types of information about anglers are not explored, such as their age, ethnicity, subsistence uses of catch, and cultural values of fishing. Nonetheless, the basic survey platform and procedures are in place to allow adjustments and add-ons as new information needs are identified. In many cases, this could mean increasing sample size temporally or geographically, or for a given gear type or fishery. In other cases, a separate add-on survey may be a better way to collect the desired data. If some type of state or federal saltwater fishing registry is developed, its use as a sample frame would obviously have to be considered.

In the western Pacific, the need for comparable data on non-finish is also important. The harvest of those species that are regularly collected in Hawaii marine waters, such as limu (seaweed), opihi (limpets), and tako (octopus), is necessary for any ecosystem-based management approach. In the CHTS, the definition of saltwater fishing effort specifically excludes shellfish, e.g., crabbing. While information on some of these species is collected through the field survey if encountered, catch estimates are only developed for finfish.

It is also critical to fully analyze and evaluate the raw data coming from the phone and field surveys each year to identify important trends in recreational fishing patterns as well as possible modifications of the survey questions or coding needed to improve the survey. We were surprised to find that no agency or analyst currently makes full use of the data. Even though the raw data are available and well documented, no one has taken a systematic look at the complete array of survey information and how it relates to other information about fish

catch and fishing effort in Hawaii. The NOAA MRFSS staff uses only the data needed to compute their annual catch and effort estimates.

We do not make any policy recommendations in this report; NMFS and its partners are currently (as of 2008) reviewing MRFSS procedures nationwide and developing a new system for collecting recreational fisheries data, called the Marine Recreational Information program (MRIP). That program is expected to lead to changes in data collection procedures both in Hawaii and elsewhere. Instead, we suggest some changes of a more technical nature that could be incorporated into existing or new data collection procedures.

One recommendation is to consider hiring one or more analysts to ensure annual reports take full advantage of the survey data available and that survey results could be fed back into sampling and survey design procedures.²³ Regular analysis would also permit identification of trends; currently only trends in effort and catch are available on the NOAA Web site. Other desired analyses include comparison of catch and effort on weekends compared to weekdays and additional analysis of fishermen categories (purely recreational, recreational expense, and commercial). The ahi example provided in this report demonstrates the types of analysis that are possible.

Suggestions from Workshop

HMRFS Workshop attendees had several suggestions for additional survey questions. The issue of subsistence use of fish and other cultural benefits could be explored by adding questions to the field survey or to the economic add-on survey when implemented in Hawaii. The Council expressed a desire to have additional information about angler ethnicity and use of fish for cultural purposes and information on the incidence of subsistence vs. sport fishing and the relationships between them.

The HMRFS project enables analysis of the raw data (but not development of catch estimates) separately for “purely recreational” anglers who never sell fish, “expense” recreational anglers who sometimes sell fish to help cover costs, and commercial anglers, who regularly sell fish for income. There probably are various hybrids of these three categories that change seasonally, temporally, or even within a trip; a trip that starts out as a recreational trip, for example, could turn into a trip where fish are sold if catch is greater than anticipated and the angler has a CML license. Other analyses suggested by workshop participants were to explore differences between weekend and weekday fishing patterns, seasonality, and changes in fishing target species over time.

Another workshop participant made a comment heard and discussed by NOAA and HDAR staff previously—that the hours of sampling may miss many night fishermen whose catch and effort patterns could differ from those of day fishermen. This includes not only fishing that takes place only at night, but trips lasting more than a day with the boat possibly returning to the dock or ramp very early in the morning (such as bottomfishing). This serious

²³ Protocol for compiling the raw phone and field survey data into a consistent, useable format could be developed based on the 2003 analysis experience.

issue and likely source of bias applies not just to Hawaii, but the rest of the coastal states, and may be addressed in the current national effort to redesign MRFSS. Initial discussion with the HMRFS project manager suggested that night sampling may be feasible on Molokai on a test project basis.

Through our analyses and feedback from workshop participants, a number of recommendations were developed. These and similar changes could be facilitated by greater local control of the field survey, ranging from additional analysis and adaptive design of the instrument and sampling procedures to local development of catch estimates. Many agency employees and stakeholders have requested that the phone survey be conducted locally rather than by a national contractor to reduce the problems of interviewers' lack of familiarity with Hawaii gear, species, and language. The MRFSS staff in Silver Spring appears amenable to such discussions as long as national data needs are met.

Telephone Survey Technical Recommendations

Several specific changes are suggested for the telephone survey. Hawaii-specific questions were designed in 2001 to accommodate state and federal partners. This review has highlighted the need for evaluation of their current and future utility.

Fisherman Categorization

This series of questions has added value to Hawaii data and should be continued. Reexamination of the fishermen categories, through focus groups or other means, could be done periodically, since current analyses rely heavily on angler interpretation of the questions designed to capture this information. If the questions are being interpreted as intended, the categorization questions effectively capture most of the information required for local managers and other interested parties. Comparisons revealed that the proportions of recreational, recreational expense, part-time commercial, and full-time commercial anglers sampled in the CHTS matched proportions observed in the field survey, adding validity to the phone results.

A few minor changes could add value to the data already collected and increase efficiency in the CATI. Managers would like to know whether identified full-time commercial fishermen hold a commercial marine license. We recommend that this question be asked once a Category 3 or 4 (part-time or full-time commercial) angler is identified, although noting that it is a sensitive question because of the potential for self-incrimination (an angler would be admitting to breaking the law if commercial fishing without a license).

Full-time commercial trip data are not used to develop estimates. However, they could be included in the raw data file to allow the analysis of the reported data by full-time commercial fishermen. In addition, inclusion of the fisherman category variable in the trip file would allow researchers to compare trip characteristics across fisherman categories.

Island of Return

Information on island of return for fishing trips was not obtained with consistency over the last several years. In fact, while data on the island the trip returned to were collected at the outset of the survey in 2001, the contractor inadvertently switched to county of return in 2003 (county is the standard in the rest of the country). Since Maui County includes the islands of Molokai, Lanai and Maui, island-specific trip information was lost in 2003 and 2004. As a result of this review, island of return has been restored, allowing all profiled trips to be categorized by island and county in 2005. This is the preferred means of collecting this information for local management needs.

Hawaii Target Species

Of the 4200 trips profiled in the 2003 telephone survey, less than half had a specific target species. We could obtain better data on specific species, namely jacks and tunas, if we decided to build on the areas where we currently get the most information. Maintaining such a long species list to obtain minimal data on most of them is not very cost effective. Shortening this list to include specific species of interest would aid in interviewer training and angler response. We currently have 2 full years of data to identify the major species identified by anglers interviewed as part of the household survey. Adding the potential to cross-reference existing species and groups used for management purposes would also increase local utility of the results; this strategy could be used for the field survey as well.

Field Survey Technical Recommendations

Monitoring Interviews

With regard to the field survey, regular monitoring of the survey effort should include documentation and analysis of refusals, tracking of the number and type of substitute days and sites, and regular visits with field interviewers to ensure systematic treatment of issues as they arise.

Survey Content

Some field questions appear to need modification because they are regularly misinterpreted by anglers. For example, 14% of the fishermen who said they were bottomfishing reported using a tuna handline, showing that some anglers believed that bottomfishing was referring to fishing depth rather than species (i.e., targeting bottomfish).

Adding a limited number of additional questions about angler characteristics should be considered. Currently, few demographic questions are included, limiting the ability to assess trends in fishing patterns and project changes based on population variables. At a minimum, questions on ethnicity and age could be included without being too intrusive to the fishermen. A question on the importance of fish and fishing for subsistence and to meet cultural needs and values would also be extremely useful.

Data Entry

Changes in data entry procedures also could be considered. Currently, for example, one can combine the field survey Type 1 (angler) database with the Type 2 (observed catch) database or the Type 3 (unobserved catch) database, but it is difficult to combine all three without the loss of some valuable data fields. An alternative approach would be to design a program that would merge the files or add some variables to each file.

A Work in Progress

As a result of the HMRFS workshop and related presentations, some positive events have already occurred, in addition to a better collective understanding of the survey and its appropriate applications. Some misunderstandings about Hawaii geography (such as the location and nature of Kalawao County and the Island of Kahoolawe) were corrected for use in the telephone survey. As another example, one issue discussed was the difficulty obtaining participation of the Kewalo-based Oahu charter fleet. The day after the workshop, the former Council Chairman talked to one of the charter operators about the problem.

Another example was a recent article in *Hawaii Fishing News* providing information about how to distinguish yellowfin from bigeye tuna, especially at the juvenile stage. This article addressed a concern workshop attendants had about the scarcity of bigeye tuna caught on intercepted trips in 2003 (just one fisherman who had caught 10 bigeye). Some attendees mentioned that bigeye tuna could be misidentified as yellowfin. Another *Hawaii Fishing News* article described the HMRFS project and its uses, along with some results, to encourage anglers to participate in the study. HMRFS would benefit from other outreach efforts, including presenting results and asking anglers to comment on questions and coding.

Finally, with the review completed and additional discussions underway, the stage was set for the first angler expenditure survey, which began in 2006. NOAA Fisheries worked with the HDAR field survey project staff to conduct this add-on during the 2006 calendar year. The effort included adding a limited number of questions at the end of the field survey to collect economic data on that particular fishing trip. A wider range of demographic questions (e.g., gender, employment status, household income, ethnicity, education level) was included in the form of a mail survey to fishermen willing to participate when contacted in the field.

The questionnaire collected information on annual sport fishing expenditures designed to allow development of estimates of average expenditures per trip (stratified by mode and residence status), average annual expenses per angler on durable goods (boat, cars) and economic impacts for the State of Hawaii, (how many jobs, how much income those expenditures produce). The mail survey also provided a forum for limited additional questions of value to fishery managers. For example, supplemental questions asking specifically about the economic value of blue marlin and other pelagic species were added to the 2006 mail survey.

Although it is possible that substantial changes may be made to the telephone and field surveys in the future to improve the validity and reliability of recreational catch estimates, the value of analyzing the raw data files will remain. Such analysis will help to interpret the catch estimates, develop hypotheses about causes of changes observed from year to year and help to ground-truth the catch estimates. Sharing the results of analysis of the raw data with recreational fishermen, managers, and researchers—ideally with all three groups present to allow for interaction—would increase confidence in both the results and their application in management. This collective understanding will be critical as the application of recreational information becomes more important in managing western Pacific fisheries.

REFERENCES

Hamilton, M. S., and S. W. Huffman.

1997. Cost-earnings Study of Hawaii's Small Boat Fishery, 1996-1996. University of Hawaii, Joint Institute for Marine and Atmospheric Research. SOEST 97-06, JIMAR Contribution 97-314.

National Research Council.

2006. Review of Recreational Fisheries Survey Methods. Report by Committee on the Review of Recreational Fisheries Survey Methods, National Research Council. ISBN: 0-309-66036-X, 190 pages. Available at: <http://www.nap.edu/catalog/11616.html>

Appendix A: Phone Survey Questionnaire

COASTAL HOUSEHOLD TELEPHONE SURVEY QUESTIONNAIRE

Wave 5, 2004

Version dated: October 4, 2004

Intro {If state of residence = HI}

Hello. I'm calling to conduct a survey for the State of Hawaii's Division of Aquatic Resources and the U.S. National Marine Fisheries Service.

[AS NEEDED: May I please speak with an adult in the household?]

We are collecting information for use in conservation of coastal resources. We would appreciate your help with this important study. Before we begin, I want to assure you that your answers will be kept confidential, this call may be monitored for quality assurance, and that no information will be provided to any kind of tele-marketing firm.

Q1 How many people in this household go fishing?

Q1CHECK {If Q7 > 15}

[INTERVIEWER: Response is greater than 5, please prompt to confirm total number of people fishing in household.]

Q2 Have I reached you on the island of {restore island name}?

{LABEL RESIDENCE}

Q3 Is this your permanent residence?

[AS NEEDED: Where you live at least 6 months out of the year.]

Q4 How many people in total, including yourself, live in your household?

{if Q1 < 0, add:}

Please include those people who fish and who don't fish.

Q4CHECK {If Q15 > 8}

[INTERVIEWER: Response is greater than 5, please prompt to confirm total number of people living in household.]

{If Q1 = 0, dispo = NFISHING; go to Q20/Gender}

Q4ERROR {If Q15 < Q7}

[INTERVIEWER: Your response indicates that there are fewer people living in the household than there are fishers in the household! Please clarify with the respondent as needed.]

Q5 We want to gather information from people who have been recreational saltwater fishing. Saltwater fishing includes fishing in oceans, sounds, or bays, or in brackish portions of rivers. This does not include fishing in freshwater, or for shellfish, such as crabbing. Recreational fishing means the primary purpose of the fishing is for fun or relaxation, as opposed to providing income from the sale of fish.

{if state = HI add:}

How many people in your household, including children and adults, have been recreational saltwater fishing in the last 12 months anywhere in the US, including Hawaii and the mainland, or in a US territory?

Q6 *{Ask if Q5 > 1}*

{if state = HI}

Thinking just about the past **2 months**, have you been recreational saltwater fishing in the US, including Hawaii and the mainland, or a US territory?

{if state = HI}

Just to be clear, we're talking about people who live with you in your household and not family or friends who live in different households.

[Maximum = 20. If response is greater than 5, prompt to confirm number of people who have been recreational saltwater fishing in the last 2 months.]

Q7 INTERVIEWER: Record gender of respondent

1 male

2 female

Q8 I'd like to ask each person who has been recreational saltwater fishing in the last 2 months a few questions about their fishing trip(s). What are the first names of the people in your household who have been recreational saltwater fishing in the past 2 months?

[NOTE TO INTERVIEWER: If respondent won't give you names, ask for identifiers such as mother, father, oldest child, second oldest child, etc]

SECTION 2 - MAIN QUESTIONNAIRE

Q9 Are you one of the people in your household who has been saltwater fishing in the last 2 months?

{LABEL ANGLER INTRO}

Q10 I'd like to ask you a few questions about your most recent fishing trips. Of course, all of your answers will be kept confidential. This survey is conducted in accordance with the Privacy Act of 1974. You are not required to answer any question that you feel is an intrusion of your privacy.

Q11 First, did all of the fishermen in your household take all of their fishing trips together over the last 2 months?

{LABEL LOOP1_START}

Q12 *{if state = HI}*

On how many days, in the past two months, between *{TODAY-2 Months}* and *{TODAY-1}*, did you (s/he) go saltwater fishing in Hawaii or from a boat launched from Hawaii?

HI3 *{if state of residence = HI}*
Which of the following three (3) categories best represents your fishing activities?

- 1 You never sell any of your catch
- 2 You sometimes sell fish to help cover fishing expenses
- 3 You sell fish for profit to pay your living expenses
- 8 DK
- 9 REFUSED

HI3B *{If HI3 = 3}*
Do you consider yourself a full-time commercial fisherman?

- 1 YES
- 2 NO
- 8 DK
- 9 REFUSED

{Fishermen categorization codes}

If HI3 = 1, then category = 1 (pure recreational)

If HI3 = 2, then category = 2 (recreational expense)

If HI3 = 3 and HI3B = no, then category = 3 (part-time commercial)

If HI3 = 3 and HI3B = yes, then category = 4 (full-time commercial)}

HI3C *{Ask if HI3 = 3}*
How many of the *{total trips}* trips that you mentioned were commercial fishing trips?

[AS NEEDED: For this survey, any trip where you sold some of the catch for profit beyond expenses is considered to be a commercial fishing trip.]

HI3D *{if HI3 < total trips}*
Were the other *{total trips-HI3}* trips purely recreational trips (where you sold none of the catch)?

HI3E *{If HI3D = 2}*
How many were purely recreational?

HI13_CHECK *{if HI3E +HI3C > total trips}*
[INTERVIEWER: the respondent's total trips don't add up, please probe for the correct information.]
You entered:
- Total in-state trips
- Total out-of-state trips
- Commercial trips
- Recreational trips}

{If HI3E = 0 or if H3C = total trips (all commercial), fisherman interview ends as non-2 month fisher}.

HI13_FOLLOW *{If HI3D > 0}*
We'd like to ask you about just those recreational fishing trips.

{LABEL **TRIPLOOP START**}

Q14 When did you (s/he) last go saltwater fishing? I have a calendar with me in case we need to look up some of the specific dates.

NEXT LOOP: Can you tell me the date of the saltwater fishing trip prior to that one?

Q15 [INTERVIEWER: record day. If respondent can't remember the day, ask if it was a weekday or weekend. You may prompt for answers by using your calendar]

Q16 On that day, did you (he/she) fish from a boat?

Q17 {Ask if Q16 = 1, took a boat trip}

{If state of residence = HI}

Was that from a...

[INTERVIEWER: You may choose up to two responses but the CANNOT be from the same category]

2 Charter boat -- CATEGORY B {set BoatB=1}

3 Personal or friend's (private) boat -- CATEGORY C {set BoatC=1}

4 Rented boat? -- CATEGORY C {set BoatC=1}

5 Boat - don't know what type -- CATEGORY C {set BoatC=1}

[INTERVIEWER: Using mode definitions, probe before choosing this answer]

{LABEL **HIcharter**}

H18 INTERVIEWER: If charter boat, ask:
"Are you the captain or member of the crew of a charter boat?"

H19 {If HICaptain = 1 and first charter trip claimed}
For this study, we are only interested in those trips you might have taken for your own enjoyment where you did NOT have paying customers. From now on, please only tell me about trips where you did NOT have paying customers. On the trip you just mentioned, did you have paying customers?

H19B {if HICaptain = 1 and not first charter trip claimed}
On the trip you just mentioned, did you have paying customers?

H20 {if HICaptain = 1}
For the rest of the survey, please consider only those trips that you took for your own personal enjoyment.

{LABEL **BoatLoop**}

Q21_a To what **coastal** county did your (his/her) boat return?

001 Hawaii {save as CountyReturn_b}

003 Oahu/Honolulu {save as CountyReturn_b}

005 Kalawao (includes cities of Kalaupapaa and Kalawao) {save as CountyReturn_b}

007 Kauai {save as CountyReturn_b}

009 Maui (includes Kahoolawe, Kahului, Lanai and most of Molokai Islands)

Targ_1a Were you targeting any particular kinds of fish on this trip?
{Up to four responses allowed, responses 64-99 exclusive}

- 1 A'awa (ah-ah-vah)" or Table Boss
- 2 A'u (pronounced ow)
- 3 Ahi (ah-hee)
- 4 Aholehole (ay-ho-lay-ho-lay)
- 5 Aku (ah-koo)
- 6 Akule (ah-koo-lee)
- 7 Albacore (albacore tuna)
- 8 Amberjack
- 9 Barracuda
- 10 Bigeye (bigeye tuna)
- 11 Billfish
- 12 Blue marlin
- 13 Bonefish
- 14 Convict tang
- 15 deep water bottomfish
- 16 Ehu (ay-hoo)
- 17 Gindai (gin-dye)
- 18 Goat fish
- 19 Hahalalu (ha-ha-la-loo)
- 20 Hapu'upu'u (ha-poo-oo-poo-oo, or ha-pa-poo for short)
- 21 Hinalea (he-na-lay-ah)
- 22 Ina (ee-na)
- 23 Kaku (ka-koo)
- 24 Kawakawa (kava-kava)
- 25 Kumu (koo-moo)
- 26 Mahi (mahimahi)
- 27 Malu (ma-loo)
- 28 Manini (ma-nee-nee)
- 29 Marlin
- 30 Menpachi
- 31 Moana (mo-ah-na)
- 32 Moi
- 33 Moonfish
- 34 Mu (moo or mo-ee)
- 35 Nabeta (na-beh-ta)
- 36 Nehu (nay-hoo)
- 37 Oama (oh-ah-mah)
- 38 Oio (oh-ee-oh)
- 39 Omilu (oh-me-loo)
- 40 Onaga or naga (oh-na-gah or na-gah)
- 41 Ono (oh-no)
- 42 Opah (oh-pah)
- 43 Opakapaka (oh-pa-ka-pa-ka or paka)
- 44 Opelu (oh-pell-oo)
- 45 Opihi (oh-pee-hee)
- 46 Palani (pah-lah-nee)
- 47 Papio (pa-pee-oh or pah-pee-oh)
- 48 Parrot fish

- 49 reef fish
- 50 Sailfish
- 51 Sea bass
- 52 Skipjack (skipjack tuna)
- 53 Spearfish (short nosed spearfish)
- 54 Striped marlin
- 55 Taapae (Ta-ah-pay or tah-ah-pay)
- 56 Tako (ta-co)
- 57 Tombo
- 58 Tunas
- 59 Uhu
- 60 Ulua (oo-loo-ah)
- 61 Wahoo (wah-who)
- 62 Weke (ve-kee)
- 63 Yellowfin (yellowfin tuna)
- 64 No particular target
- 65 Other [record response]

Gear_1a

What kind of fishing did you do on this trip? Was it trolling, hand-lining, bottom-fishing, casting with a rod and reel or pole and line, netting, scuba or spear-fishing or something else?

- 01 Trolling
- 02 Hand-lining
- 03 Bottom-fishing
- 04 Casting [Rod and reel or pole and line]
- 05 Netting
- 06 Spear-fishing [scuba or free-diving]
- 07 Other {record response}

Gear_2a {if gear_1a = 2}

And what method of hand-lining was that? Tuna hand-lining, deep water bottom-fishing, or shallow water bottom-fishing or something else?

- 1 Tuna hand-lining [includes palu ahi or ika shibi]
- 2 Deep water bottom-fishing
- 3 Shallow water bottom-fishing
- 4 Other {record response}

Gear_3a {if gear_1a = 3}

And what method of bottom fishing was that? Deep water bottom-fishing, shallow water bottom fishing, both deep and shallow or something else?

- 1 Deep water bottom-fishing
- 2 Shallow water bottom-fishing
- 3 Both deep and shallow
- 4 Other {record response}

Cat_1a{if HI3 > 1}

Did you sell any of your catch on this particular trip?

{LABEL SHORE}

Q22 {if state of residence = HI and Q16 ne 1}

On that day, did you fish from the shoreline or reef? (also means piers, docks, jetties, etc.)

Gear_1b

What kind of fishing did you do on this trip? Was it trolling, hand-lining, bottom-fishing, casting with a rod and reel or pole and line, netting, scuba or spear-fishing, or something else?

- 01 Trolling
- 02 Hand-lining
- 03 Bottom-fishing
- 04 Casting [Rod and reel or pole and line]
- 05 Netting
- 06 Spear-fishing [scuba or free-diving]
- 07 Other

{record response}

Gear_2b {if gear_1b = 2}

And what method of hand-lining was that? Tuna hand-lining, deep water bottom-fishing, or shallow water bottom-fishing or something else?

- 1 Tuna hand-lining [includes palu ahi or ika shibi]
- 2 Deep water bottom-fishing
- 3 Shallow water bottom-fishing
- 4 Other

{record response}

Gear_3b {if gear_1b = 3}

And what method of bottom-fishing was that? Deep water bottom-fishing, shallow water bottom-fishing, both deep and shallow or something else?

- 1 Deep water bottom-fishing
- 2 Shallow water bottom-fishing
- 3 Both deep and shallow
- 4 Other

{record response}

Cat_1b {if HI3 > 1}

Did you sell any of your catch on this particular trip?

Q23 On what coastal **coastal** county were you (was he/she) fishing?

- 001 Hawaii {save as CountyReturn_b}
- 003 Oahu/Honolulu {save as CountyReturn_b}
- 005 Kalawao (includes cities of Kalaupapaa and Kalawao) {save as CountyReturn_b}
- 007 Kauai {save as CountyReturn_b}
- 009 Maui (includes Kahoolawe, Kahului, Lanai and most of Molokai Islands)

Targ_1c Were you targeting any particular kinds of fish on this trip?
 {Up to four responses allowed, responses 64-99 exclusive}
 (same species list)

Gear_1c What kind of fishing did you do on this trip? Were you casting with a rod and
 reel or pole and line, netting, scuba or spearfishing, or something else?

- 1 Rod and reel [includes pole and line]
- 2 Netting
- 3 Spearfishing [scuba or free-diving]
- 4 Other {record response}

Cat_1c {if HI3 > 1}
 Did you sell any of your catch on this particular trip?

CONT77 {IF TripUp NE 0}
 [INTERVIEWER: Did you choose this response because ...]
1 the respondent does not remember any more details about ANY trips; or
2 the respondent refuses to continue; or
3 proxy respondent does not know trip details;
4 all of the remaining trips were like the one we just talked about.
5 respondent needs to change number of trips.

RM_1 For the remaining {restore number of remaining trips not discussed} days, could you
 at least please tell me how many times and in what state and county or US territorial
 island you fished from a party/charter boat, a private/rental boat, and the shore?

- 1 respondent will continue
- 2 need to change number of initial trips {set change = 1}}
- 9 respondent refused

[INTERVIEWER - COMPARE LIST OF COMPLETED NAMES WITH FISHERMEN
NAMES AND ASK FOR THE PEOPLE WHO HAVE NOT YET BEEN COMPLETED.
If respondent indicates that one or more of the people list are children, ask current
respondent to continue answering the questions based on the child's fishing activities]

- 1 YES -- transferring
- 2 child on list -- respondent will do survey now for child {skip to Q77}
 {set Count1 = Count1+1}{set AskProxy = 1}{set NOINTRO = 1}
- 3 NO -- No other anglers available at this time {set ask proxy = 1}

Q24 {Ask if AskProxy = 0}

I understand that you've been recreational saltwater fishing in the past 2 months, and
I'd like to ask you a few questions about your most recent trips. Of course, all of your
answers will be kept confidential. The survey is conducted in accordance with the
Privacy Act of 1974. You are not required to answer any question that you feel is an
intrusion of your privacy.

 {skip to Label Loop1_Start, Count1 = Count1+1}

Q25 Thank you for your assistance. That concludes this survey. Have a good day/night.

Appendix B: Field Survey Questionnaire



2. ASSIGNMENT NO. Please indicate if this is your first or second assignment today, by writing "1" or "2"

3. INTERVIEWER ID

4. YR/MO/DAY

5. INTERCEPT NO.

6. INTERVIEW TIME (use 2400 clock)

Time this interview was completed

7. STATE CODE 8. COUNTY CODE 9. SITE CODE

10. INTERVIEW STATUS 1 ☐
(Key Item = *) 2 ☐
5 ☐

Questionnaire Complete
Refused Non-Key Item
Refused Key Item

READ PRIVACY ACT. This study is being conducted in accordance with the privacy act of 1974. You are not required to answer any question that you consider to be an invasion of your privacy.

*11. Would you say you were fishing from a..

- SH 1. ☐ Pier/Dock CH 7. ☐ Charterboat
2. ☐ Jetty, Breakwater, Breachway PR 8. ☐ Private Boat
3. ☐ Bridge, Causeway
4. ☐ Other Man-made Structure (Specify) _____
5. ☐ Natural Shoreline (beach, cliffside, etc.)

*12. Was most of your (specify mode) fishing effort today in the..

1. ☐ Ocean
4. ☐ Bay
5. ☐ Other (Specify) _____ Code q. 13 as "8"

*13. Was that 1. ☐ Three Miles or Less from Shore (always for SH mode)
2. ☐ More than Three Miles 8. ☐ Does not apply.

13a. If 13 = "More than Three Miles", then:

Were you fishing at or near a Fish Attracting Device (FAD) today?

☐ Yes ☐ No

At which FAD(s) did you fish today?

14. What type of gear was primarily used?

- 01 ☐ Rod & Reel 11 ☐ Trap
→ Go to 14a. 12 ☐ Spear
02 ☐ Hand Line 13 ☐ Hand
→ Go to 14b. 14 ☐ Crab Net
03 ☐ Hand Pole 15 ☐ Other (Specify) _____
04 ☐ Scoop Net
05 ☐ Throw Net 98 ☐ Unknown
06 ☐ Gill Net 99 ☐ Refused
07 ☐ Cross Net
08 ☐ Hukilau
09 ☐ Surround Net
10 ☐ Trawl

14a. What METHOD was primarily used?

☐ 1. Trolling ☐ 2. Casting

→ Go to 15

☐ 3. Bottom Fishing ☐ 4. Hand Lining

14b. If bottom fishing or hand lining were you

1. ☐ Shallow Water (-20 fms)
2. ☐ Deep Water (+ 20 fms)
3. ☐ Tuna Handling (Hand Line Only)

15a. To the nearest half-hour, how many hours have you spent (specify mode) fishing today? That is, how many hours have you actually spent with your gear in the water?

.

15b. (Only ask if natural shoreline mode [#11, SH=5]) How many additional hours do you expect to fish from shore today? That is, how many more hours will you actually have your gear in the water?

.

16. Were you fishing for any particular kinds of fish today? If Yes, what kinds?

☐ No particular species/Anything

1st Target

2nd Target

16a. Were you fishing for finfish today?

1. If Yes ☐ 2. ☐ No, continue to 16b

16b. Did you catch any finfish today?

☐ Yes ☐ No

17. Not counting today, within the past 12 months, that is since (insert month) of last year, how many days have you gone recreational saltwater fin fishing in Hawaii?

No. of Days, Code 998 Don't Know
Code 999 If Refused

18. Not counting today, within the past 2 months, how many days have you gone recreational saltwater finfishing in Hawaii?

No. of Days, Code 98 Don't Know
Code 99 If Refused

19. Do you ever sell any of the fish you catch?

1 ☐ Yes 2 ☐ No, Go to 20

19a. When you sell your fish, do you consider yourself a commercial fisherman, trying to make some income or do you sell only to cover your fishing expenses?

1 ☐ For Income 2 ☐ Trip Costs Only,
Go to 20

19b. Do you consider yourself a full-time commercial fisherman?

1 ☐ Yes 2 ☐ No

*20. What is your state and island or county of residence? If county unknown ask: What city or town do you live in?

State Code; Name

County - Island Code;
Name

21. What is the zip code of your residence?

Zip Code

Code: 99997 Foreign Country

Code: 99998 Don't Know

Code: 99999 Refused

22. Do you live in a private residence, or in some type of housing such as a dorm, barracks, nursing home or rooming house?

1 ☐ Private Residence 8 ☐ Don't Know
2 ☐ Institutional Housing 9 ☐ Refused

→ Go to verification box

23. Does your home have a land line telephone?

1 ☐ Yes 8 ☐ Don't Know
2 ☐ No 9 ☐ Refused

VERIFICATION BOX

In the event my supervisor wishes to verify that I have been conducting interviews here today, may I have your name and a phone number?

Angler's First & Last Name

☐ Name and phone number not given

D or N (Cell) Phone #

*24. UNAVAILABLE CATCH. Did you land any fish that are not here for me to look at? For example, any that you may have thrown back or used for bait? IF YES, COMPLETE TYPE 2 RECORD FOR THIS INDIVIDUAL FISHERMEN, NOT GROUP CATCH. NOTE: FILLETS ARE UNAVAILABLE CATCH.

DISPOSITION CODES FOR Q24

- 1 Thrown back alive / legal
2 Thrown back alive / not legal / legality refused
3 Eaten / plan to eat
4 Used for bait / plan to use for bait
5 Sold / plan to sell

- 6 Thrown back dead / plan to throw away
7 Some other purpose. Write in margin > _____
8 Refused
9 Exchange, Trade

TYPE 2 RECORDS: (INDIVIDUAL CATCH UNAVAILABLE IN WHOLE FORM)

NAME	SPECIES CODE	#OF FISH	DISP	NAME	SPECIES CODE	#OF FISH	DISP
1. _____				2. _____			
3. _____				4. _____			
5. _____				6. _____			
7. _____				8. _____			
9. _____				10. _____			

*25. Did you catch any fish I can look at?

- 1 ☐ Yes
2 ☐ No - Code q. 26, 27, 28 as "8's," Not Applicable
3 ☐ Yes, BUT fish on another fishermen's form -
Fill in Interview # where fish are listed
 - Code q. 26, 27, 28 as "8's," Not Applicable

*26. Did you catch these yourself or did someone else catch some of them?

- 1 ☐ All Caught by fishermen -- Code q. 27, 28, as "8's," Not Applicable
2 ☐ Other Contributors 8 ☐ Not Applicable

*27. Can you separate out your individual catch?

- 1 ☐ Yes - Code 28 as "88's"
2 ☐ No 8 ☐ Not Applicable

*28. How many fishermen including yourself have their catch here? Please do not include anyone who did not catch fish. Only count those who have their catch here.

No. of Contributors 88 ☐ Not Applicable

*29. How many people fished on your boat today?

No. of People 88 ☐ N/A or Shore Mode

BOX D. If response to q. 29 is 01 or Shore Mode code as 8 = N/A or Shore Mode. Otherwise, is this the first fishermen from this boat that I have interviewed?

- 1 ☐ Yes 8 ☐ N/A or Shore Mode
2 ☐ No - Record interview # of 1" fishermen in the fishing party. *

*30. AVAILABLE CATCH. COMPLETE TYPE 3 RECORD BY ASKING: May I look at your fish? What do you plan to do with the MAJORITY of the (species)?

DISPOSITION CODES FOR Q30

- 3 Eaten / plan to eat 5 Sold / plan to sell 7 Some other purpose 9 Refused
4 Used for bait / plan to use for bait 6 Thrown back dead / plan to throw away 8 Don't know / Didn't ask 0 Exchange, Trade

TYPE 3 RECORDS: (INDIVIDUAL CATCH AVAILABLE IN WHOLE IDENTIFIABLE FORM)

SPECIES NAME	CODE	#OF FISH	PLAN TO SELL	LENGTH (mm)	WEIGHT (kg)	DISP
1. _____						
2. _____						
3. _____						
4. _____						
5. _____						
6. _____						
7. _____						
8. _____						
9. _____						
10. _____						

31. If Charter boat mode, is the vessel on the ACTIVE Charter Boat List: ___ Yes ___ No

(Please fill in Charter boat name)

31a. Charter Boat Name: _____ Captain: _____
Address: _____ Phone: _____ Cell: _____

